

requirements for the provision for safety in marine boilers and engines. The want of uniformity here again is undoubted.

Lieut. B. Baden-Powell described a means he suggested for navigating the air by means of kites. He pointed out that as greater height above the surface of the earth is reached, the wind nearly always increases in force. At 1000 yards it often blows at three times the velocity that it does near the surface. He proposes to take advantage of this difference by sending one kite to the upper atmosphere, and keeping another nearer the ground. The two kites would be connected by a long line, and the weight to be carried would be attached to the line at a point nearer to the lower kite than to the higher. The lower kite would thus supply a retarding medium to the upper, so that the effect would be the same in principle, though not in degree, as if the upper kite were held to the earth by a string, and the lower kite were towed through the air by a boy running with the string in his hand. By the forces thus brought to bear both kites would be kept flying although not held to the earth by a string in the usual way, and it is thought that possibly they might be navigated in directions other than that in which the wind might be blowing. It will be seen that the author depends on the difference in velocity of currents of air at two heights; and were this difference to fail, or to become insufficient, the experimenter would come to the ground. This might prove awkward unless a clear field were provided for the descent. The suggestion however is ingenious, and no doubt many persons interested in the problem of aerial navigation would be pleased to see the author put his theories to the test of practice.

The last paper presented at the meeting was a contribution by Prof. A. E. Elliott, of Cardiff, on receiver and condenser drop. It is a subject that deserves far more consideration and discussion by members of the Section than they were able to give on hearing it read rapidly at the end of the meeting. Papers of this nature should be read at one meeting, and the discussions adjourned until another; or perhaps it would be better to distribute them two or three months before the meeting, and dispense with reading altogether. A joint meeting of Sections A and G would afford the appropriate audience for considering the subject of Prof. Elliott's memoir.

BOTANY AT THE BRITISH ASSOCIATION.

THE President (Mr. Thiselton-Dyer) exhibited photographs and specimens of a large cedar (*Cedrus Deodara*, Loud.) from Kew, which had been struck and completely shattered by lightning on August 10. It was pointed out that the main stem had been in part blown into matchwood by the violence of the shock, and branches were torn off with large portions of the trunk adhering to their base. Prof. Oliver Lodge took part in the discussion as to the probable explanation of the unusual nature of the explosion, which seemed to have been centrifugal, the stem having been disrupted from the centre, and not merely stripped superficially.

Prof. Bretland Farmer described a set of wax models illustrating the typical forms passed through, and the chief variations exhibited, by the chromosomes during the division of the nucleus in the spore-mother cells of plants. The wax employed is made of a mixture of one part of white wax, with five parts of paraffin, the melting point of which is about 50° C.

THALLOPHYTA.

Experimental studies in the variation of yeast cells, by Dr. Emil Chr. Hansen (Copenhagen). The author gave an account of his earlier and more recent investigations. Among the latter he especially dwelt on those in which, by one treatment, varieties were produced that gave more, and by another treatment less, alcohol than their parent cells. He pointed out that the observed variations could be grouped under certain rules. From his researches on the agencies and causes to which variation is due, he found that temperature was the most influential external factor.¹

A false *Bacterium*, by Prof. Marshall Ward, F.R.S.

On the formation of bacterial colonies, by Prof. Marshall Ward, F.R.S.

On the structure of bacterial cells, by Harold Wager. In this paper an account was given of the present state of our know-

ledge of the cells of bacteria. Reference was made to the observations of Schottelius, Migula, De Bary, Bütschli, and others. The author showed that it is possible to demonstrate in the majority of bacterial cells the presence of two substances, one of which may be regarded as protoplasmic in nature, and a second, which stains deeply when acted upon by fuchsin and kindred staining substances, and which may be regarded as nuclear. It was pointed out that this nuclear substance does not possess the structure of nuclei in the cells of higher plants.

Note on the occurrence in New Zealand of two forms of Peltoid *Trentepohliaceae*, and their relation to the lichen *Strigula*, by A. Vaughan Jennings. The *Trentepohliaceae* which form epiphyllous cell-plates are at present known only from the tropics. They have been recorded from South America, India, Ceylon, and the East Indies, but not up to the present time from New Zealand. The author gave a summary of previous literature, and described two forms found by himself in New Zealand. (1) *Phycopeltis expansa*, sp. nov. This species forms wide-spreading yellow cell-plates on the leaves of *Nesodaphne*; it bears two kinds of sporangia, and is often associated with brown fungus hyphae growing between the cell rows, but not affecting the growth of the alga. On the other hand, when attacked by different hyphae, the result is the formation of the lichen *Strigula*, which in Ceylon was shown by Ward to have for its algal element *Mycosidea parasitica*, Cunn. (2) *Phycopeltis nigra*, sp. nov. On leaves of *Nesodaphne* and fronds of *Asplenium falcatum*. Two distinct varieties of this species were described. The plant is never attacked by fungus hyphae, and never takes any part in lichen formation, even when on the same leaf with *Phycopeltis expansa* and the associated *Strigula*.

BRVOPHYTA AND PTERIDOPHYTA.

On a supposed case of symbiosis in *Tetraplodon*, by Prof. F. E. Weiss. The author exhibited specimens of *Tetraplodon* from the Cuchullin Hills in Skye, where it was found plentifully on animal excreta. In September he found many of the patches mixed with an orange-coloured *Pezia*, which did not appear to have in any way injured the moss plants. The rhizoids of the moss, however, contained in many cases fungal hyphae closely resembling those of the *Pezia*, and though present in the cells of the moss, these latter did not seem to be injured by them. He suggested that this might be an instance of symbiosis; the moss, as in the case of other green plants, making use of the fungal hyphae to obtain its nutriment from the organic material. The ultimate proof of such a case of symbiosis would, however, necessarily depend upon culture experiments, which he understood were now being made by another observer.

Remarks on the Archegonium, by Prof. F. O. Bower, F.R.S. Prof. Bower pointed out that the recognition of the archegonium as consistently of hypodermal origin cannot be upheld, and quoted as exceptions *Equisetum*, *Isoetes*, *Ophioglossum*, and especially the leptosporangiate ferns. He laid down the general principle that the sporangia, as regards their development, should be studied in the light of a knowledge of the apical meristems of the plants in question. Where the apical meristems are stratified, the archegonium is hypodermal in the usual sense; where initial cells occur, the archegonium is derived by periclinal divisions of superficial cells. Intermediate types of meristem show an intermediate type of origin of the archegonium. He cited as an illustrative case that of *Ophioglossum*, admitting that the hypodermal band of potential archegonium, which he had previously described, does not occur always or in all species. But so far from thus giving up the case for a comparison with *Lycopodium*, he holds that as *Ophioglossum* has a single initial cell in stem and root, it would be contrary to experience to expect or demand a hypodermal archegonium. (The details will shortly be published elsewhere, with illustrations.)

On the prothallus and embryo of *Danea*, by G. Brebner. Mr. Brebner gave an account of the prothallus and sexual organs of *Danea simplicifolia*, Rudge, as the result of investigations made on some material from the Botanic Gardens in British Guiana. He pointed out that there is a close similarity between the *Danea* and the other two genera of the *Marattiaceae*, *Angiopteris* and *Marattia*, of which the prothallus has been previously described. An interesting fact was noted as regards the prothallus rhizoids, which possess a distinctly septate structure, and so far resemble a moss protonema. Possibly similar septate rhizoids may be found in the other marattiaceous genera. The development of the antheridia of *Danea* agrees in the main with that in *Marattia* and *Angiopteris*:

¹ A fuller account of Dr. Hansen's work will be published in the *Annals of Botany*.

the material did not allow of any developmental study of the archegonia. The concentric bundle of the primary embryonic stem shows an endodermal layer. On the whole the author found in *Danica* a complete agreement, in all essential features, with *Angiopteris* and *Marattia*, as regards prothallus, reproductive organs, and embryo development.

PHYSIOLOGY, &c.

The localisation, the transport and rôle of hydrocyanic acid in *Pangium edule*, Reinw., by Dr. M. Treub (Buitenzorg, Java).—Five years ago Dr. Greshoff made the remarkable discovery that the poisonous substance contained in great quantities in all the parts of *Pangium edule*, was nothing else than hydrocyanic acid. This interesting chemical discovery was the starting-point of Dr. Treub's physiological investigations. In microchemical researches hydrocyanic acid presents a considerable advantage as compared with the great majority of substances to be detected in tissues by reagents; namely, that the Prussian blue reaction, easily applicable in microchemical research, gives completely trustworthy results. The appearance of Prussian blue in a cell may be accepted as certain proof of the previous occurrence in the cell of hydrocyanic acid, no other substance producing the same reaction. The leaves prove to be the chief factories of hydrocyanic acid in *Pangium*, though there are other much smaller local factories of this substance in the tissues of other organs. The hydrocyanic acid formed in the leaves is conducted through the leaf-stalks to the stem, and distributed to the spots where plastic material is wanted. The acid travels in the phloem of the fibro-vascular bundles. Dr. Treub regards the hydrocyanic acid in *Pangium edule* as one of the first plastic materials for building up proteids; he thinks it is, in this plant, the first detectable, and perhaps the first formed product of the assimilation of inorganic nitrogen. In accordance with this hypothesis, the formation of hydrocyanic acid in *Pangium* depends, on the one hand, on the presence of carbo-hydrates or analogous products of the carbon-assimilation, and, on the other hand, on the presence of nitrates. These two points were proved, or at least rendered acceptable, by a great number of experiments made by Dr. Treub in the Buitenzorg Gardens. (The details of this investigation will be found in a paper appearing in the forthcoming number of the *Annales de jardin botanique de Buitenzorg*.)

On the diurnal variation in the amount of diastase in foliage leaves, by Prof. Reynolds Green, F.R.S. The diastase which is present in foliage leaves varies in amount during the day, being greatest in the early morning, and least after sunset. The cause of the variation has been ascertained to be chiefly, if not entirely, due to the action of the sunlight. The author showed last year, at the Oxford meeting, that diastatic extracts exposed to sunlight or electric light, without the interposition of any form of screen, have their activity largely impaired, the damage amounting sometimes to 70 per cent. Experiments made upon the living leaf of the scarlet-runner showed a similar destructive action of the light, the amount of destruction only amounting, however, to about 10 to 20 per cent. The author attributes this difference to the screening action of the proteids in the cells of the leaf.

On cross and self fertilisation, with special reference to pollen prepotency, by J. C. Willis. The time has passed for regarding self-fertilisation as being always necessarily harmful in itself, and it is now recognised as a regular feature in the life-history of many plants. There are many species of plants in which both self and cross pollination occur nearly, or quite, simultaneously, and it is very desirable to know what happens in these cases. Darwin's experiments render it probable that prepotency of foreign pollen is usual. The author's experiments have been devoted to a study of the relative chemical attraction of "own" and "foreign" pollen by the same stigma (chiefly in gelatine and agar cultures), and have given negative results. It seems probable, putting together all the various known facts, that prepotency, where it occurs, is due to actions set up after the pollen tubes have entered the stigma, these actions tending to favour the growth of the "foreign" pollen-tubes, and to check that of the "own" pollen.

PALÆOBOTANY.

The chief results of Williamson's work on the Carboniferous plants, by Dr. D. H. Scott, F.R.S. The origin and history of the late Prof. Williamson's researches on the Carboniferous flora were briefly traced. His great work, chiefly, though not entirely,

contained in his long series of memoirs in the *Philosophical Transactions* of the Royal Society, consisted in thoroughly elucidating the structure of British fossil plants of the Coal period, and thus determining, on a sound basis, the main lines of their affinities.

Four of the principal types investigated by Williamson were selected for illustration—the *Calamariæ*, the *Sphenophylleæ*, the *Lyginodendree*, and the *Lycopodiaceæ*.

(1) The *Calamariæ*.—Williamson's great aim, which he kept in view all through, was to demonstrate the essential unity of type of the British Calamites, i.e. that they are all Cryptogams, of equisetaceous affinities (though sometimes heterosporous), but possessing precisely the same mode of growth in thickness by means of a cambium, which is now characteristic of Dicotyledons and Gymnosperms. His researches have given us a fairly complete knowledge of the organisation of these arborescent Horse-tails.

(2) The *Sphenophylleæ*, a remarkable group of vascular Cryptogams, unrepresented among living plants, but having certain characters in common both with *Lycopodiaceæ* and *Equisetaceæ*, are now very thoroughly known, owing, in a great degree, to Williamson's investigations. The discovery of the structure of the fructification, absolutely unique among Cryptogams, was in the first instance entirely his own.

(3) The *Lyginodendree*.—The existence of this family, which consists of plants with the foliage of ferns, but with stems and roots which recall those of Cycads, was revealed by Williamson. This appears to be the most striking case of an intermediate group yet found among fossil plants.

(4) The *Lycopodiaceæ*.—Williamson added enormously to our knowledge of this great family, and proved conclusively that *Sigillaria* and *Lepidodendron* are essentially similar in structure, both genera, as well as their allies, being true Lycopodiaceous Cryptogams, but with secondary growth in almost all cases. He demonstrated the relation between the vegetative organs and the fructification in many of these plants, and by his researches on *Stigmara*, made known the structure of their subterranean parts. The different types of *Lepidodendron*, of which he investigated the structure, were so numerous, as to place our knowledge of these plants on a broad and secure foundation. (The paper was illustrated by lantern-slides, partly from Williamson's figures, and partly original.)

On a new form of fructification in *Sphenophyllum*, by Gra Solms-Laubach (Strassburg). Graf Solms gave a brief sketch of the history of our knowledge of the fructification of the Carboniferous genus *Sphenophyllum*. He described the type of strobilus originally named by Williamson *Volkmannia Dawsoni*, and subsequently placed by Weiss in the genus *Bowmanites*; this fructification has recently been shown by Williamson and Zeiller to belong to *Sphenophyllum*. The author proceeded to give an account of a new form of strobilus recently obtained from rocks of Culm age in Silesia; this shows certain important deviations from the fructifications previously examined. In the *Sphenophyllum* strobili from the Coal-Measures the axis bears successive verticils of coherent bracts, the sporangia are borne singly at the end of long pedicels twice as numerous as the bracts, and arising from the upper surface of the coherent disc near the axil. In the Culm species, *Sphenophyllum Römeri*, sp. nov., the bracts of successive whorls are superposed and not alternate, as described by other writers, in the Coal-Measure species; a more important feature of the new form is the occurrence of two sporangia instead of one on each sporangiophore or pedicel.

In the course of his remarks, Graf Solms referred to the unique collection of microscopic preparations of fossil plants left by Prof. Williamson; he emphasised in the strongest terms the immense importance of the collection, and pointed out how every worker in the field of Palæozoic botany must constantly consult the invaluable type specimens in the Williamson cabinets.

On English amber, by Dr. Conwentz (Danzig). The author of this paper gave an account of the Baltic and English amber, and its vegetable contents. After describing the different forms of Tertiary amber, he referred to the occurrence of succinite on the coasts of Essex, Suffolk, and Norfolk; the specimens being usually found with seaweed, thrown up by the tides. Occasionally pieces have been met with weighing over two pounds. Dr. Conwentz described the method of examining the plant fragments enclosed in amber, and compared the manner of preservation with that of recent plant sections mounted in Canada balsam. The amber was originally poured out from the roots,

stems, and branches of injured or broken trees, in the form of resin, which on evaporation became thickened, and finally assumed the form of succinite or some similar substance. For the most part the fossil resin has been derived from the stems and roots of coniferous trees of the genus *Pinus*. In addition to the exceptionally well-preserved tissues of coniferous trees, the Baltic amber has yielded remarkable specimens of monocotyledonous and dicotyledonous flowers. Some of the most striking examples were illustrated by means of the excellent coloured plates from Dr. Conwentz' monographs on the Baltic amber.

The Wealden flora of England, by A. C. Seward. Mr. A. C. Seward, after referring to the various species described by Mantell, Carruthers, Starkie Gardner, and others, from the Wealden strata of England, briefly described a large number of plants from the British Museum collection. During the last few years Mr. Rufford, of Hastings, has obtained an extremely valuable and rich collection of plants from Ecclesbourne, Fairlight, and other localities; and these have now become the property of the nation. The following species are at present known from the Wealden of England; some of these have already been figured in the first volume of the catalogue of the Wealden flora, and the remainder are dealt with in the forthcoming second volume:—*Algites valdensis*, sp. nov., *A. catenelloides*, sp. nov., *Chara Knowltoni*, sp. nov., *Marchantites Zeileri*, sp. nov., *Equisetites Lyelli*, Mant., *E. Burchardti*, Dunk., *E. Yokoyamæ*, sp. nov., *Onychiopsis Mantelli* (Brong.), *O. elongata* (Geyl.), *Acrostichopteris Ruffordi*, sp. nov., *Matonidium Göpperti* (Ett.), *Protopteris Witteana*, Schenk., *Ruffordia Göpperti* (Dunk.), *Cladophlebis longipennis*, sp. nov., *C. Albertsii* (Dunk.), *C. Browniana* (Dunk.), *C. Dunkeri* (Schimp.), *Sphenopteris Fontainei*, sp. nov., *S. Fittoni*, sp. nov., *Weichselia Mantelli* (Brong.), *Teniopteris Beyrichii* (Schenk.), *T. Dawsoni*, sp. nov., *Sagenopteris Mantelli* (Dunk.), *S. acutifolia*, sp. nov., *Microdictyon Dunkeri*, Schenk., *Dictyophyllum Römeri*, Schenk., *Leckenbya valdensis*, gen. et sp. nov., *Tempskya Schimperii*, Cord., *Cycadites Römeri*, Schenk., *C. Saporæ*, sp. nov., *Dioonites Dunkerianus* (Göpp.), *D. Brongniartii* (Mant.), *Nilssonia Schaumburgensis* (Dunk.), *Otozamites Klipsteinii*, (Dunk.), *O. Göppertianus* (Dunk.), *Zamites Buchianus* (Ett.), *Zamites Carruthersi*, sp. nov., *Anomozamites Lyellianus* (Dunk.), *Cycadolepis*, *Carpolithes*, *Androstrobus Nathorstii*, sp. nov., *Conites elegans* (Carr.), *C. armatus*, sp. nov., *Bucklandia anomala* (Stokes and Webb), *Fittonia Ruffordi*, sp. nov., *Bennettites Saxbyanus*, Brown, *B. Gibsonianus*, Carr., *B. (Williamsonia) Carruthersi*, sp. nov., *Yatesia Morrisii*, Carr., *Withania Saporæ*, gen. et sp. nov., *Becklesia anomala*, gen. et sp. nov., *Dichopteris*, sp., *Sphenolepidium Kurrianum* (Schenk.), *S. Sternbergianum* (Dunk.), *Pagiophyllum crassifolium* (Schenk.), *Brachyphyllum obesum*, Heer, *B. spinosum*, sp. nov., *Pinites Solmsi*, sp. nov., *P. Dunkeri*, Carr., *P. Mantelli*, Carr., *P. patens*, Carr., *P. Carruthersi*, Gard., &c.

SCIENCE IN THE MAGAZINES.

THE personal reminiscences of Huxley, contributed by Mr. George W. Smalley to the current number of *Scribner*, will bring up pleasant memories to those who were honoured by the friendship of the departed naturalist, and they form an affectionate tribute "to the memory of one of the truest men who ever lived, one of the manliest, and in all points the noblest." There is in the article so much real testimony to Huxley's greatness, that every student of science will appreciate it. "The emancipation of thought," truly says Mr. Smalley, "that is Huxley's legacy to his century—that was his continual lesson of intellectual honesty." Against those who criticised Huxley's philosophical learning we quote these words: "In truth he was a very expert metaphysician, with an extraordinary knowledge of the literature of metaphysics and philosophy. . . . Huxley was a student, and more than a student, of Descartes. He has written the best short book in existence on Hume. He was a pupil of Aristotle, and therefore not a Platonist. Hobbes taught him much; Berkeley was to him a great thinker; Locke, Butler, and the short list of really great names in English philosophy were all his familiars, while among the great Germans there was, I think, none whom he did not know well—Kant, Hegel, Fichte, and that illustrious line, not excepting Schopenhauer." But Huxley's claim to recognition as one of the world's foremost thinkers, now unhappily lost to us, need not be enlarged upon here. "He will be remembered as the great physiologist, the

great student, the great controversialist, the great thinker and writer. That he will be remembered need not be doubted. The world, it may still be said, does not willingly let die the memory of those who have made it a better world to live in, whose lives as well as whose teachings have been lessons of devotion, of high aims, of wide accomplishments, of honourable purpose; whose achievements are written imperishably in the annals of their own time. Huxley was one of these, and his monument in his life's endeavour. There will be no need to inscribe Right Honourable upon his tomb. The name he bore through life will serve both for epitaph and eulogy."

There are other articles in *Scribner* which will interest the readers of NATURE. One of these is a fully illustrated description of the new Chicago University, by Mr. Herrick. Magnificent buildings have been erected, and an endowment of over £1,200,000 has been bestowed in the short period of four years, as well as a generous annual budget for current expenses. This phenomenal generosity, together with the fact that there will be no question of adequate support as fresh opportunities for development occur, point to the University of Chicago as a great and growing centre of intellectual activity. In some respects the system of the University resembles that of our older Universities, but others—such as the emphasis placed upon the doctor's degree, investigation, research, &c., and the activity of the graduate schools—point to the German University as the prevailing influence. It will astonish many of our schoolmen to know that "the graduates in residence this year—in all over three hundred—form more than one-third of the entire body of students, a larger number than at any other American University. This preponderance of graduate students has been brought about by several reasons: the emphasis placed upon the advanced courses under the leadership of such heads of departments as Profs. Dewey, Hale, von Holst, Laughlin, Michelson and Nef, not to mention others; the special privileges and distinctions granted to graduates (for example, in many departments only graduate students are allowed in the special departmental laboratories, the £6000 annually offered in fellowships and scholarships; and the equal privileges accorded to women. It is a truism that the most distinctive move in American college life of the last decade has been in the sudden interest in post-graduate study. But hitherto in Western institutions, whether college or so-called university, has had the means to provide liberally for advanced studies." It will be clear from this quotation, and more clear from a perusal of the article, that the University of Chicago is developing in the right directions towards scholarship and new knowledge. Chicago people seem to have the cause of higher education at heart, and they are devoting their best energies, as well as generous financial support, to the magnificent institution which has so quickly sprung into existence, and which has such a great future before it.

The third article of scientific interest in *Scribner* is of "Domesticated Birds," by Prof. N. S. Shaler, and is beautifully illustrated.

The sixth of Mr. Herbert Spencer's papers on professional institutions, contributed to the *Contemporary*, deals with the evolution of men of science and philosophers, and will, therefore, be of exceptional interest to our readers. So far as the series has as yet gone, it has been shown that the institutions dealt with were probably derived from the priesthood. Whatever may be the opinion with regard to the connection between the medical profession and priestcraft, it will be generally conceded that astronomy received its first impulse from the exigencies of religious worship. Extracts given by Mr. Spencer from Rawlinson, Layard, and Maury show clearly how closely religion and science (especially astronomical science) were mingled by the Babylonians. With the Egyptians, too, there is abundant evidence to prove an intimate connection between their science and their religion; and the connection is established by the fact that "in every temple there was . . . an astronomer who had to observe the heavens." Astronomy was thus an outgrowth of religion, and the natural knowledge accumulated by the priests formed the beginnings of sciences in Egypt, Assyria, and India. The Greeks imported this knowledge; in other words, they obtained their early science in a slightly developed state. Of the indebtedness of the Greek philosophers to the Egyptian priests there is no doubt whatever, and Mr. Spencer clearly makes out that obligation. The development of Greek science, however, is only in a small measure ascribed to the priesthood, the advances being more of secular than of sacred origin. "During those centuries of darkness which